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The definition of heart failure

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Although everybody feels they know what heart failure means, there is no generally accepted definition. The following opinions and definitions describe the conflicting situation: 'It should be obvious that the diagnosis of cardiac failure, like that of many other diseases, depends upon its definition, which varies with different authorities'[1]. 'Since no single measurement discriminates between the normal and failing heart, no definition of heart failure is universally accepted'[2]. 'We have yet to wait for a reliable and reproducible test that will tell us if a heart is good or bad'[3]. 'To date virtually all studies of congestive heart failure have been hampered by the lack of consistent diagnostic criteria and comprehensive follow-up evaluation'[4]. 'For the present, heart failure may be defined as the pathologic condition in which an abnormality of cardiac muscle function is responsible for the inability of the heart to pump blood at a level adequate to meet metabolic tissue demands'[5]. 'Heart failure is the pathophysiologic state in which an abnormality of cardiac function is responsible for the failure of the heart to pump blood at a rate commensurate with the requirements of the metabolizing tissues'[6]. 'Heart failure is the abnormal condition in which disturbed cardiac performance is primarily responsible for the inability of the heart to pump blood at a rate commensurate with systemic metabolic requirements'[7]. 'In practice, heart failure is best described in terms of its two primary sets of clinical manifestations, pulmonary congestion and peripheral hypoperfusion'[8]. 'Cardiac failure (*Herzinsuffizienz*) means insufficient cardiac output; i.e. at rest or at exercise abnormal myocardial function (e.g. abnormal increase of ventricular filling pressure and/or of end-diastolic ventricular volume) may be present in spite of normal cardiac output (i.e. without cardiac failure)'[9].

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Thus, the main problem in defining heart failure arises from the fact that a large number of different definitions seem to be necessary for a detailed description of all the conditions and viewpoints which are referred to heart failure.

Since we feel that one has clearly to distinguish between the normal state, an abnormal state of the heart and *heart disease*, and since we feel not only that the output of the heart is important but also how the cardiac output is delivered to the tissues, a new definition seems to be mandatory. For a general use, the following definition is suggested:

Heart failure is the state of any heart disease in which, despite adequate ventricular filling, the heart's output is decreased or in which the heart is unable to pump blood at a rate adequate for satisfying the requirements of the tissues with function parameters remaining within normal limits.

This definition is applicable for all clinically used subsets of heart failure such as latent, congestive, overt and low output heart failure. *Latent heart failure* is then defined as a state in any heart disease in which the heart is unable to pump blood at a rate adequate for satisfying the requirements of the tissues *during stress* with function parameters remaining within normal limits, i.e. this definition implies that although the heart may be able to satisfy the requirements of the tissues during stress, the function parameters do not remain within normal limits. In all other subsets of heart failure, irrespective of whether cardiac output is normal or depressed, function parameters at rest are *not* within normal limits.

In the suggested definition the term 'function parameters' means all features characterizing the activity of the heart as a pump and/or as a muscle.

From this definition of heart failure it becomes evident that heart failure is not solely defined by commonly used criteria, i.e. cardiac output and the metabolism of the tissues.

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Editor's Comment

OMNIS DE SCRUTIO PERECULOSA EST (Every definition is dangerous) — ERASMUS

Our distinguished colleagues are to be admired both for their courage and for their caution in defining heart failure. We have already had problems with definitions in the European Heart Journal, partly because of a misunderstanding of the use of the word 'definition'. In standard English, 'definition' has two quite separate meanings — one, the meaning of a word, and the other, the fundamental nature of a thing. Clearly, Professors Denolin, Kuhn, Krayenbuehl, Loogen and Reale are addressing themselves to the first concept of definition, and it is this concept that it is hoped that further contributors to the Journal will address.

Whether an agreed definition of heart failure will be achieved remains to be seen. The Editor hopes that his vanity will be excused if he quotes himself:

> 'Failure in anything implies expectations unfulfilled, and one's definition of heart failure depends upon what one expects of the heart. No single definition suffices because the clinical and physiological criteria necessarily differ. The clinician regards his patients as having heart failure when there are symptoms or physical signs attributable to inadequate cardiac performance. The physiologist regards the heart as failing when the contractility of the ventricles or the cardiac output fall outside the statistically defined normal range . . . .'[1]

In the Editor's view, definitions are extremely useful in ensuring that two parties in a controversy or discussion are talking about the same thing, but they pose difficulties when the same term changes its meaning depending upon the context in which it is used. Furthermore, the definition of a word or phrase changes with the passage of time, both because of greater understanding and because of natural changes in linguistic usage. He therefore feels that more than one definition of 'heart failure' should be agreed depending on the specific contexts in which the term is used but that these definitions should be subject to periodical review.

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Comment by E. Braunwald (Boston, MA, USA)

In the opening paragraph of his classic text, *Diseases of the Heart,* published in 1933, Sir Thomas Lewis stated: 'The very essence of cardiovascular practice is recognition of early heart failure'[1]. How correct he was! Heart failure occurs as the consequence of many forms of heart disease, and in the United States alone afflicts at least 4 million individuals of all ages. In its chronic form, heart failure is generally associated with a poor prognosis, and it is one of the most common of all causes of death. It causes much personal suffering and places enormous economic burdens on the patient, his family, and on society at large[2].

Despite the central role of heart failure in cardiology, this syndrome remains poorly defined a half century after Lewis; hence the need for a definition, which is clearly provided by Professor Denolin and his distinguished colleagues. As they indicate, my definition of heart failure is that it is 'the pathophysiologic state in which an abnormality of cardiac function is responsible for failure of the heart to pump blood

at a rate commensurate with the requirements of the metabolizing tissues'. Implicit in this definition are fundamental differences between failure of the myocardium, heart and circulation. Myocardial failure always produces heart failure, but the converse is not necessarily the case, since a number of conditions in which the heart is suddenly overloaded (e.g. acute aortic regurgitation secondary to infective endocarditis) can produce heart failure in the presence of normal myocardial function. Also, conditions such as tricuspid stenosis and constrictive pericarditis, which interfere with cardiac filling, can produce heart failure *without* myocardial failure. Heart failure, in turn, always produces circulatory failure, but again the converse is not always true, since a variety of noncardiac conditions, e.g. hypovolemic shock or extremely severe anemia, beriberi, and other high-output states can produce circulatory failure at a time when cardiac function is normal or only modestly impaired[3].

It is useful to have a working definition of heart failure since recent advances in cardiac physiology, pharmacology and surgery make it likely that we are now at the threshold of major advances in the diagnosis and treatment of this extremely important condition[4].

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Comment by D. G. Gibson (London)

HEART FAILURE—AN OBSOLETE TERM?

The idea of 'heart failure' is an important one for cardiologists. They document its presence, seek to prevent its occurrence and treat it with a variety of drugs notable for their potency and their incidence of side effects. It is thus distressing that no satisfactory definition of 'heart failure' has hitherto been propounded; the efforts of your contributors to provide one will thus be seen as correspondingly laudable, and the results of their deliberations studied with interest. Taking into account their last paragraph, it may be stated as follows: Heart failure is the state of *any* heart disease in which

(1) the heart's output is decreased, or

(2) function parameters are outside normal limits even though cardiac output is normal for tissue requirements.

This definition seems to me to have a number of limitations which will make it unsuitable for clinical use. Disregarding the use of the unsatisfactory term 'parameter', the definition of 'function parameters' itself is not clear. The authors suggest that it means 'all features characterizing the activity of the heart as a muscle and/or pump', but this is scarcely a rigorous definition. Would the authors take an increase in septal thickness, for example, to be such an abnormality? I suspect not, but what about an increase in left ventricular mass, which would make a diagnosis of left ventricular hypertrophy synonymous with heart failure? Other problems arise when diastolic disturbances are considered. Whereas a reduction in the rate of ventricular relaxation would clearly fit in with their definition, does the same apply to the passive stiffness of the ventricle, which is independent of whether or not the heart shows any activity as a muscle or a pump? The definition also depends critically on these functional parameters being within normal limits, but gives no indication as to how these limits are to be defined. Are 95% confidence limits to be used? If this is the case, 5% of a normal population will have values outside them, and if many separate 'parameters' are measured, the chances of any normal subject fulfilling the criteria for 'heart failure' will be greatly increased. The definition as it stands includes values on either side of the normal range. Are we to believe that an abnormally high value of ejection fraction, for example, constitutes evidence of heart failure? The definition also includes 'any' heart disease, and so would presumably encompass mitral stenosis, supraventricular tachycardia, or constrictive pericarditis. When combined with the authors' views on the significance of any departure from normal of a function parameter, this leads to

further complications. A measurable diastolic gradient across the mitral valve or a positive systolic gradient across the aortic valve in the second half of ejection are both very abnormal, and are both function parameters in the sense used in the definition. Any patient with more than the mildest mitral or aortic stenosis would thus be categorised as being in heart failure. The same applies for mild valvular regurgitation, using an increase in end-diastolic volume as the criterion. It appears, therefore, that any patient with any measurable cardiac abnormality under any circumstances, along with a significant proportion of normal subjects, hypertensives of any severity, and subjects in whom ventricular function measurements are unusually good will be regarded, on the suggested criteria, as being in heart failure. I do not believe that such a definition will have any clinical, epidemiological, or theoretical value.

The term 'heart failure' is primarily a clinical one, and dates from an earlier era of medicine. The problem arises when its use must be reconciled with the results of physical measurements of pressure, volume, or flow, quantities that can be defined rigorously in terms of simple Newtonian physics. Heart failure has never been defined in this way, so that its meaning must be established indirectly. The authors have attempted to do this by examining its definition from a number of sources, and demonstrated their incompatibility with one another. However, if one wishes to establish what a group of individuals mean by a word, it is often more rewarding to watch the way they use it rather than asking them to define it. This applies as much to medical authors as to any other group. Although the definitions given by the various authorities cited differ, their clinical accounts of the entity they deem to be heart failure are remarkably uniform. It is a condition associated with symptoms and signs. We are on familiar ground when we read of breathlessness on exertion, nocturnal dyspnoea or fatigue. On examination we find peripheral oedema, elevation of the venous pressure, or gallop rhythm. It is this clinical syndrome that most of us call to mind when heart failure is mentioned rather than a single abnormality of some function parameter. A major component of this symptomatology is due to abnormal renal function, whose cause is not clearly understood, but which cannot easily be related to the adequacy or otherwise of its blood flow or metabolism, another of the suggested criteria. It might be questioned whether it is worth while even attempting to define heart failure in more rigorous terms, or whether the term should be allowed to lapse, as has happened with others, such as 'the vapours'. I think that it should be preserved, provided that its limitations are accepted, since it embodies a clinical approach older and more complex than that of assessing patients by simply comparing function parameters with presumed normality. The idea of 'failure' of an organ is a pervasive one in clinical medicine. It can be applied to kidney, liver, and lungs as well as to the heart. It includes the concept of a final common pathway in the clinical course, which is independent of the original aetiology of the disease; it is a definite and advanced step in the natural history of the condition, with characteristic clinical features and therapeutic consequences. If treatment is successful, it may be possible to make the evidence of 'failure' regress, although the underlying disease remains present. Unlike a simple anatomical or physiological diagnosis, therefore, a patient can go 'in' and 'out' of failure. Function is often held to be in some sense 'compensated' until its onset. Whether such a quantum step in the natural history of heart disease can be defined on a clear physical basis is uncertain. Starling[1] suggested that it might represent the stage at which one of the major homeostatic mechanisms was exhausted; such an approach is clearly defined and could be re-examined in the light of control system theory. If such a stage could, indeed, be identified, then it might be appropriate to equate it with the idea of heart failure as elaborated clinically. However, I do not believe that this is yet possible. It may well become so, since one neglects clinical information at one's peril, but until it does, I think it is more valuable to regard the term 'heart failure' as a useful clinical description only. It should certainly not be regarded either as a diagnosis or as a single clinical entity; rather its appearance should be seen as a challenge to determine the nature of unique haemodynamic disturbance present in the individual patient, so that optimum treatment can be given.

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